NON-PUBLIC?: N
ACCESSION #: 9510060015
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Nine Mile Point Unit 2 PAGE: 1 OF 5

DOCKET NUMBER: 05000410

TITLE: Reactor Manual Scram to Protect Turbine-Generator from
High Vibrations
EVENT DATE: 05/30/95 LER #: 95-005-01 REPORT DATE: 09/29/95

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 015

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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Unit 2 Engineering Manager

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On May 30, 1995 at 1403 hours, Nine Mile Point Unit 2 (NMP2) initiated a manual scram signal resulting in a full reactor scram. The manual scram was initiated in order to break condenser vacuum, thereby quickly slowing the turbine generator which was experiencing excessive vibration during a turbine coastdown. At the time of the scram, the reactor mode switch was in the "RUN" position and the plant was operating at 15 percent of rated thermal power with a turbine generator coastdown in progress.

The proximate cause of the event was turbine bearing vibration beyond allowable in connection with the startup of new low pressure turbine rotors. A thorough technical evaluation performed by an outside contractor determined that the root cause of the high vibrations which led to the reactor scram was the result of the clearances established by the new low pressure turbine design. A contributing cause was the

operational approach followed in startup of the new turbine.

Immediate operator actions included commencing scram recovery activities and placing the plant in a stable condition. Systems which could have been affected by the high turbine vibration were inspected and found acceptable. The process of bri
ging the turbine on-line during a
subsequent plant startup was handled as a special evolution, using a Special Test Procedure with revised vibration limits and other restrictions. Additional corrective actions established as a result of the technical review performed by an outside contractor include: disseminating the design experience of this modification throughout Design Engineering, and revising the Turbine Operating Procedure (N2-OP-21) and Preventive Maintenance Procedure (N2-PM-RC@003) to include specific steps to more effectively avoid and mitigate future rubs.

END OF ABSTRACT

I. DESCRIPTION OF EVENT

On May 30, 1995 at 1403 hours, Nine Mile Point Unit 2 (NMP2) initiated a manual scram manual scram signal resulting in a full reactor scram. The manual scram was initiated in order to break condenser vacuum, thereby quickly slowing the turbine generator which was experiencing excessive vibration during a turbine coastdown. At the time of the scram, the reactor mode switch was in the "RUN" position and the plant was operating at 15 percent of rated thermal power with a turbine generator coastdown in progress.

At about 1357 hours, while increasing turbine speed to about 1550 revolutions per minute (rpm), NMP2 experienced high vibrations on the number 6 bearing of the turbine generator. The Station Shift Supervisor (SSS) ordered a turbine trip in accordance with operating procedure N2-OP-21. As the turbine was coasting down through the 1200 to 1000 rpm range, turbine vibration began to increase in amplitude. The SSS ordered a reactor scram by placing the mode switch to Shutdown in preparation for breaking vacuum. He then directed the condenser vacuum breakers to be opened. In response to the low vacuum in the condenser, the Main Steam Isolation Valves closed. No Emergency Operating Procedures were required to be entered.

All control rods inserted to "Full In" on the scram signal without exception or complication. No safety relief valves lifted during this event. Reactor vessel water level dropped to approximately 163 inches

indicated and then rose to approximately 199 inches indicated.

All reactor and balance of plant systems responded to the scram as expected. The scram was reset at 1411 hours.

II. CAUSE OF EVENT

The proximate cause of the event was turbine bearing vibration beyond allowable in connection with the startup of new low pressure turbine rotors. The turbine vendor indicated that vibration resulting from "packing rub" is expected following maintenance of the type performed during the just completed refueling outage. The low pressure turbine rotors had been replaced with a new "mono-block" design during the refueling outage. A thorough technical evaluation performed by an outside contractor determined that the root cause of the high vibrations which led to the reactor scram was the result of the clearances established by the new low pressure turbine design. A contributing cause was the operational approach followed in startup of the new turbine.

The excessive turbine vibrations resulted from the development of a thermally unstable rub. This type of rub cannot be worked out since the heating developed from the rub is sufficient to cause thermal expansion of the affected components thereby worsening the condition. The

II. CAUSE OF EVENT (cont'd)

high rate of change of vibration resulting from this type of rub severely limits the ability of the operators to avoid a high vibration problem when the rate of change of vibration is not considered in the operating limits.

The turbine roll leading up to the reactor scram included an extensive period of time (greater than one hour) spent at 800 rpm to allow warmup of the turbine lube oil. This hold allowed the rotor to undergo significant thermal expansion prior to initiating the roll to 1800 rpm. This thermal expansion further closed the low pressure turbine clearances increasing the severity of the rubs experienced. The unit operating procedures did not include any restrictions on turbine expansion during startup. In addition, the operating procedure used during the startup only included a limit on the magnitude of the vibration. As result of the design and the operating conditions established prior to the turbine roll to 1800 rpm, the high vibration experienced could not have been avoided unless the unit was tripped at very low vibration levels (4-6 mils) when the turbine speed was still below the low pressure turbine

rotor critical range (1280 to 1800 rpm). The presence of the rubs also affects the critical speed of the rotor which exacerbates the impact of the rub on the turbine vibration.

The increase in turbine vibration experienced after the turbine trip was the result of the continuing impact of the thermally unstable rub on the vibration and the slow rate of rotor deceleration through the critical speed range. Breaking vacuum was required to effectively brake the rotor since the rubs were not relieved by the turbine trip.

III. ANALYSIS OF EVENT

This event is reportable in accordance with 10CFR50.73(a)(2)(iv), "any event or condition that resulted in a manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)."

The manual scram was initiated in order to take action to protect the turbine generator from potential damage caused by the high vibration. The event is bounded by the analysis discussed in the NMP2 Updated Safety Analysis Report (USAR) section 15.2.3, "Turbine Trip."

This event had no adverse consequences. It did not adversely affect any other safety system nor the operators' ability to maintain safe reactor plant conditions. This event in no way adversely affected the safety of the general public or plant personnel.

IV. CORRECTIVE ACTIONS

The immediate corrective actions were for operators to perform scram recovery actions, and place the plant in a stable condition. Systems which could have been affected by the high turbine vibration were inspected and determined to be acceptable.

A special procedure for bringing the turbine on line was developed for use during the subsequent plant startup. This activity was treated as a special evolution with a Special Test Procedure. The Special Test Procedure included measures which have been identified as effective in avoiding rubs, specifically tripping the turbine at lower vibration levels and minimizing the time at speeds below 1800 rpm. During the subsequent startup of the plant, the turbine repeatedly experienced higher than normal vibrations before it could be successfully brought to full speed and carry an electrical load. The subsequent turbine startup attempts did not require a reactor scram.

The following corrective actions were established as a result of a thorough technical evaluation performed by an outside contractor.

1. The Manager of Engineering will discuss the design experience of the turbine modification with his direct reports to reinforce the need to review unique design parameters. This design experience and the Manager of Engineering's performance expectations will be presented to Design Engineering personnel during scheduled staff meetings. Completion Date: October 30, 1995.

2. The Turbine Operating Procedure (N2-OP-21) has been revised, as required to include specific steps to more effectively avoid and mitigate rubs. Preventive Maintenance Procedure (N2-PM-R@003) will be revised, as required, prior to its next use during Refueling Outage 5 (RFO-5).

V. ADDITIONAL INFORMATION

A. Failed components: none.

B. Previous similar events: none.

V. ADDITIONAL INFORMATION (cont'd)

C. Identification of components referred to in this LER:

COMPONENT IEEE 803 EIIS FUNCTION IEEE 805 SYSTEM ID

Main Turbine Generator N/A TA/TB
System

Reactor Mode Switch 33 JC

Condenser COND SG

Vacuum Breakers PCV SG

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